

CLAIMS

What is Claimed is:

1. A motor vehicle, comprising:

a primary power source;

a primary driveline including a set of primary wheels;

a secondary driveline including a set of secondary wheels;

a transfer case having a primary shaft interconnecting said primary power source to said primary driveline for driving said primary wheels, a secondary shaft connected to said secondary driveline, and an electric motor driving said secondary shaft for driving said secondary wheels; and

a control system for controlling actuation of said electric motor.

2. The transfer case of Claim 1 wherein said transfer case further includes a reduction gearset having an input driven by said electric motor and an output driving said secondary shaft.

3. The transfer case of Claim 1 wherein said control system is operable to define an electric operating mode when said electric motor is actuated to drive said secondary driveline while said primary driveline is not driven by said primary power source.

4. The transfer case of Claim 1 wherein said control system is operable to define an engine operating mode when said electric motor is off such that said secondary driveline is not driven while said primary power source drives said primary driveline.

5. The transfer case of Claim 1 wherein said control system includes a controller and sensors for detecting operating characteristics of the vehicle, said controller operable for controlling independent actuation of said primary power source and said electric motor.

6. The transfer case of Claim 1 wherein said transfer case further includes a mode clutch operably disposed between said primary and secondary shafts and a clutch operator adapted to engage said mode clutch.

7. A transfer case for use in a motor vehicle having a powertrain and first and second drivelines, comprising:

a first output shaft adapted to deliver drive torque from the powertrain to the first driveline;

a second output shaft adapted for connection to the second driveline;

a reduction unit having an input member driving an output member, said output member connected to said second output shaft; and

an electric motor driving said input member of said reduction unit and operable for delivering drive torque to the second driveline.

8. The transfer case of Claim 7 further comprising a control system for controlling actuation of said electric motor to define an electric operating mode wherein said electric motor delivers drive torque to the second driveline while no drive torque is delivered from the powertrain to the first driveline.

9. The transfer case of Claim 8 wherein a hybrid operating mode is established with the powertrain delivering drive torque to the first driveline while said electric motor delivers drive torque to the second driveline.

10. The transfer case of Claim 8 wherein said control system includes a controller and sensors for detecting operating characteristics of the vehicle and sending sensor input signals to said controller, said controller operable to send control signals to said electric motor.

11. The transfer case of Claim 8 further comprising a mode clutch for selectively coupling said first output shaft to said second output shaft, said mode clutch having a power-operated clutch operator which is controlled by said control system.

12. The transfer case of Claim 11 having a transfer unit including a first sprocket rotatably supported on said first output shaft, a second sprocket fixed to said second output shaft, a power chain connecting said first and second sprockets, and wherein said mode clutch is operable in a released mode to permit rotation of said first sprocket relative to said first output shaft and in an engaged mode to rotatively couple said first output shaft to said first sprocket.

13. The transfer case of Claim 12 wherein said control system permits selection of a two-wheel drive mode, a part-time four-wheel drive mode and an automatic four-wheel drive mode, said two-wheel drive mode is established with said mode clutch in its released mode, said part-time four-wheel drive mode is established with said mode clutch in its engaged mode, and said automatic four-wheel drive mode is established with said mode clutch varied between said engaged and released modes.

14. A hybrid motor vehicle, comprising:

a powertrain including an internal combustion engine and a transmission;

a first driveline including a first differential connecting a pair of first wheels;

a second driveline including a second differential connecting a pair of second wheels;

a transfer case including a first output shaft operable for transferring power from said powertrain to said first differential, a second output shaft connected to said second differential, an electric motor having a motor output shaft, and a gearset interconnecting said motor output shaft to said second output shaft; and

a control system for controlling actuation of said electric motor for transferring power to said second output shaft.

15. The hybrid motor vehicle of Claim 14 wherein an electric operating mode is established when said electric motor is actuated for driving said second output shaft while no power is transferred from said powertrain to said first output shaft.

16. The hybrid motor vehicle of Claim 14 wherein a hybrid operating mode is established when said powertrain is actuated for driving said first output shaft and said electric motor actuated for driving said second output shaft.

17. The hybrid vehicle of Claim 14 wherein said transfer case further includes a mode clutch for selectively coupling said first output shaft.

18. The hybrid vehicle of Claim 17 wherein said transfer case further includes a transfer unit having a first sprocket rotatably supported on said first output shaft, a second sprocket fixed to said second output shaft, a power chain connecting said first and second sprockets, and wherein said mode clutch is controlled by said control system and is operable in a released mode to permit rotation of said first sprocket relative to said first output shaft and in an engaged mode to rotatively couple said first output shaft to said first sprocket.

19. A hybrid motor vehicle, comprising:
- a powertrain including an internal combustion engine and a transmission;
 - a first driveline including a first differential connecting a pair of first wheels;
 - a second driveline including a second differential connecting a pair of second wheels;
 - a transfer case including a first output shaft driven by said powertrain and operably connected to said first differential, a second output shaft operably connected to said second differential, a transfer unit coupled to said second output shaft, a mode clutch operable in an engaged mode to couple said transfer unit to said first output shaft to establish a four-wheel drive mode and in a released mode to disengage said transfer unit from said first output shaft to establish a two-wheel drive mode, and an electric motor for driving said second output shaft; and
 - a control system for controlling actuation of said mode clutch and said electric motor.

20. The hybrid motor vehicle of Claim 19 wherein said control system established a two-wheel drive electric operating mode when said mode clutch is in its released mode and said electric motor is actuated to drive said second output shaft while no power is transferred from said powertrain to said first output shaft.

21. A transfer case for use in a motor vehicle having a powertrain and first and second drivelines, comprising:

a first output shaft for transmitting drive torque from the powertrain to the first driveline;

a second output shaft adapted for connection to the second driveline;

an electric motor for selectively driving said second output shaft for transmitting drive torque to the second driveline; and

a mode clutch for selectively coupling said first output shaft to said second output shaft.

22. A hybrid motor vehicle, comprising:

a powertrain including an internal combustion engine and a transmission;

a first driveline including a first differential connecting a pair of first wheels;

a second driveline including a second differential connecting a pair of second wheels;

a transfer case including a first output shaft driven by said powertrain and operably connected to said first differential, a second output shaft operably connected to said second differential, a mode clutch for selectively coupling said first output shaft to said second output shaft, and an electric motor for selectively driving said second output shaft; and

a control system for controlling actuation of said electric motor and said mode clutch.

23. The hybrid motor vehicle of Claim 22 wherein an electric operating mode is established when said electric motor is actuated for driving said second output shaft.

24. The hybrid motor vehicle of 22 21 wherein a hybrid operating mode is established when said powertrain is actuated for driving said first output shaft and said electric motor is actuated for driving said second output shaft.

25. The hybrid motor vehicle of Claim 22 wherein said control system permits selection of a two-wheel drive mode, a part-time four-wheel drive mode and an automatic four-wheel drive mode, said two-wheel drive mode is established with said mode clutch in a released mode, said part-time four-wheel drive mode is established with said mode clutch in an engaged mode, and said automatic four-wheel drive mode is established with said mode clutch varied between its engaged and released modes.

26. A transfer case for use in a motor vehicle having an engine and first and second drivelines, comprising:

a first output shaft for transmitting drive torque from the engine to the first driveline;

a second output shaft connected to the second driveline; and

an electric motor that can be selectively actuated for transmitting drive torque only to said second output shaft.

27. A hybrid motor vehicle, comprising:

a powertrain including an internal combustion engine and a transmission;

a first driveline including a pair of first wheels;

a second driveline including a pair of second wheels;

a transfer case including a first output shaft for transmitting drive torque from said powertrain to said pair of first wheels, a second output shaft operably connected to said pair of second wheels, a reduction unit having an input member fixed to said second output shaft and an output member, and an electric motor for selectively driving said output member so as to transmit drive torque to said pair of second wheels; and

a control system for controlling actuation of said electric motor.